

Claims

1. Vehicle steering system with a device for changing the gear ratio and with an electrical auxiliary drive, the device for changing the conversion ratio containing a stator (6) and an auxiliary drive, which has a rotor, and superimposes the steering interventions of the driver over a steering wheel (20) and transfers them to the steering motion of the wheels and a housing (31), a driving unit (3), which can be driven by the steering wheel (20), and a driven element (32), which is connected with the steered wheels, as well as at least two planetary gearings, characterized in that one of the planetary gearings can be driven by the rotor of an electric motor, the driving moment, starting out from the steering wheel (20), is superimposed by the driving moment of the electric motor and are initiated jointly as output moment into the driven element (32), the ratio of the rotational speed of the driving unit (3) to that of the driven element (32) being adjustable.

2. The vehicle steering device of claim 1, characterized in that the housing (31) is connected non-rotationally with the vehicle.

3. The vehicle steering device of claims 1 or 2, characterized in that the rotational movement of the steering wheel (20) can be introduced over the driving unit (3) into one of the function parts of one of the planetary gearings.

4. The vehicle steering device of claim 3, characterized in that the rotational movement of the steering wheel can be connected by means of a coupling with the associated function parts of the associated planetary gearing.

5. The vehicle steering system of one or more of the claims 1 to 4, characterized in that the driving unit (3) can be connected in such a manner with a function part of the planetary gearing, that reaction forces from the electric auxiliary power drive have only a slight effect on the steering force.

6. The vehicle steering system of one or more of a claims 3 to 5, characterized in that the rotational movement of the steering wheel can be blocked by means of a further coupling.

7. The vehicle steering system of one or more of the claims 1 to 6, characterized in that the rotational movement of the steering wheel can be passed on directly to the driven element by means of a third coupling, the electrical auxiliary drive being severed by severing one or both of the other couplings of the electrical auxiliary power drive.

8. The vehicle steering system of one or more of the claims 5 to 7, characterized in that the three couplings are combined into one coupling unit.

9. The vehicle steering system of one or more of the claims 5 to 8, characterized in that the couplings are constructed as positive couplings.

10. The vehicle steering system of one or more of the claims 1 to 9, characterized in that the electric motor, the driving unit (3), the driven element (32) and the two planetary gearings are disposed coaxially with one another

11. The vehicle steering system of one or more of the claims 1 to 10, characterized in that it is disposed between the steering wheel (20) and the steering gear (22) and the driving device (3), the driven element (32) and the driven device (2) are constructed for transferring a rotational movement.

12. The vehicle steering system of one or more of the claims 1 to 10, characterized in that it has a conversion transmission for converting a rotational movement into a translational movement, for example, a recirculating ball screw nut, and is disposed between the steering gear (22) and at least one steering tie rod (24)

and the driving device (3) and the driven element (32) are constructed for transferring a rotational movement and the driven device (2) is constructed for transferring a translational movement.

13. The vehicle steering system of one or several of the claims 1 to 12, characterized in that the rotational speed and the direction of rotation of the driven element (32) are specified by a control device (28) on the basis of the evaluation of the actual driving situation and adjusted by way of an appropriate control of the electrical auxiliary drive.

14. The vehicle steering system of one or more of the claims 1 to 13, characterized in that only a single electric motor is used as electrical auxiliary drive.

15. The vehicle steering system of one or more of the claims 1 to 14, characterized in that the planetary gearing is constructed as a planetary gear train.

16. The vehicle steering system of claim 15, characterized in that the internal gear wheels of the planetary gear train and/or the planet wheels are constructed in two parts in the axial direction.

17. The vehicle steering of claim 16, characterized in that parts of the internal gear wheels and/or the planet wheels have different numbers of teeth from one another.

18. The vehicle steering system of one or several of claims 15 to 17, characterized in that

- the rotor of the electric motor is connected with the planet carrier (7) of the first planetary gear turning,
- one part (9) of the internal gear wheel of the first planetary gear train is connected with the housing (31),

- the second part (11) of the internal gear wheel of the first planetary gear train is connected with the first part (12) of the internal gear wheel of the second planetary gear train and
- the second part (16) of the internal gear wheel of the secondary gear train is connected with the driven shaft (2),
- the planet wheel halves (8, 10), engaging in each case the parts (9, 11) of the internal gear wheel of the first planetary gear train, are coupled of non-rotationally with one another,
- the planet wheel halves (14, 15), engaging in each case the parts (12, 16) of the internal gear wheel of the second planetary gear train, are coupled non-rotationally with one another, and
- the planet carrier (13) of the second planetary gear train can be connected switchably with
 - the drive shaft (3), which is connected with the steering wheel (20),
 - the housing (31) or
 - cannot be connected with any other gearing part, in which case the drive shaft (3) is connected directly with the driven shaft (2).

19. The vehicle steering system of one or more of claims 15 to 17, characterized in that

- the rotor of the electric motor is connected with the planet carrier (7) of the first planetary gear train,
- one part (9) of the internal gear wheel of the first planetary gear train is connected with the housing (31),
- the second part (11) of the internal gear wheel of the first planetary gear train is connected with the first part (12) of the internal gear wheel of the second planetary gear train and
- the second part (16) of the internal gear wheel of the second planetary gear train is connected with the driven shaft (2),

- the one-part sun wheels of the planetary gear trains are mounted freely rotatably and
- the planet carrier (13) of the second planetary gear train is connected switchably with
 - the drive shaft (3), which is connected with the steering wheel (20),
 - the housing (31) or
 - cannot be connected with any other gearing part, in which case the drive shaft (3) is then connected directly with the driven shaft (2).

20. The vehicle steering system of claims 18 or 19, characterized in that the switching position, for which the drive shaft (3) is connected directly with the driven shaft (2), is triggered automatically as a safety operating position when there is interference with the steering differential, especially when the engine voltage fails.

21. The vehicle steering system of claim 20, characterized in that the triggering is accomplished mechanically.